

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#2

In re the Application of

David Andrew PARKER et al

Attn: Applications

Serial No.: To be assigned

Filed: May 12, 2005

For: COMPOUNDS

CONFIRMATION OF CLAIM FOR PRIORITY

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

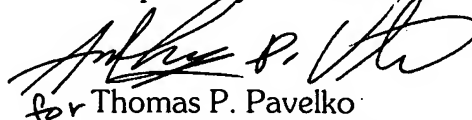
The benefit of the filing date of the following prior foreign application filed in the following foreign country is hereby requested for the above-identified application and the priority provided in 35 USC 119 is hereby claimed:

Great Britain Application No. 0404620.7, filed March 2, 2004.

A copy of the priority document was filed in the International Stage (PCT).

It is requested that the file of this application be marked to indicate that the requirements of 35 USC 119 have been fulfilled and that the Patent and Trademark Office kindly acknowledge receipt of this document.

Respectfully submitted,


for Thomas P. Pavelko

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TPP/mat
Attorney Docket No.: TPP 31765

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Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/GB05/000805

International filing date: 02 March 2005 (02.03.2005)

Document type: Certified copy of priority document

Document details: Country/Office: GB
Number: 0404620.7
Filing date: 02 March 2004 (02.03.2004)

Date of receipt at the International Bureau: 02 September 2005 (02.09.2005)

Remark: Priority document submitted or transmitted to the International Bureau in
compliance with Rule 17.1(a) or (b)



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1. Your reference	PA 5097		
2. Patent application number (The Patent Office will fill in this part)	0404620.7		02 MAR 2004
3. Full name, address and postcode of the or of each applicant (underline all surnames)	CRODA INTERNATIONAL PLC		
<p>4025102001</p> <p>Patents ADP number (If you know it)</p> <p>If the applicant is a corporate body, give the country/state of its incorporation</p>	<p>Cowick Hall Snaith Goole North Humberside DN14 9AA United Kingdom</p>		
4. Title of the invention	COMPOUNDS		
5. Name of your agent (if you have one)	Marks & Clerk		
<p>"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)</p>	<p>45 Grosvenor Road ST ALBANS Hertfordshire AL1 3AW</p>		
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Description 15

Claim(s) 6

Abstract 1

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Priority documents 0

Translations of priority documents 0

Statement of inventorship and right to grant of a patent (Patents Form 7/77) 0

Request for preliminary examination and search (Patents Form 9/77) 1

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11. I/We request the grant of a patent on the basis of this application.

Signature
Lommesv. H. Lushka/me

Date
1 March 2004

12. Name and daytime telephone number of person to contact in the United Kingdom
Dr Ian H Coates
01727 854215

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COMPOUNDS

The present invention relates to polymer additives. It is particularly applicable to additives which reduce the coefficient of friction of a polymer, such as a polyester.

Poly(ethylene terephthalate) (PET) is an important plastics material, widely used in the manufacture of moulded polyester articles and films. The key advantages of using PET are:

10

- High clarity
- Light weight
- Good processability
- Excellent barrier properties against oxygen and carbon dioxide

15

- Good impact resistance
- Tough – virtually unbreakable
- Economic

Largely as a consequence of the above properties, the most important plastic application for PET homopolymer and copolymers is in the manufacture of bottles.

PET bottles are produced predominantly using a two stage stretch blow moulding process. Firstly a preform is produced by injection moulding. This is a relatively thick – walled part with the neck features moulded during this process. The preform is then reheated in a reheat blow machine which stretches the preform by a stretching pin and inflates it by blowing air into the mould to the desired shape. This gives a biaxially orientated container which provides improved properties such as clarity and gas barrier performance. This is especially important for carbonated drink containers.

PET bottles may also be manufactured by injection blow moulding which is a 2-stage technique performed on a single machine. The preform is injection moulded and whilst still hot is moved to a blowing station where it is blown up to the desired shape. This is the preferred technique for small containers requiring specific neck detail or finish and produces containers that are less biaxially orientated.

A major difficulty in fabricating articles from PET is the relatively high coefficient of friction of the polymer. In the manufacture of bottles this problem can manifest itself in a number of ways:

- 5 • Less than optimum packing density when performs are packed into a box with concomitant higher storage and transportation costs.
- Poor flow on conveying equipment and hence reduced throughput
- Surface defects due to poor scratch resistance

10 There is thus a need for an effective additive system for PET which reduces the coefficient of friction of the polymer and thus overcomes the above deficiencies.

15 Additives that are effective in reducing the coefficient of friction of polymers are known in the industry as slip additives. However, in order to be acceptable for beverage containers, the fabricated PET bottle must exhibit low colour and high clarity, with low taste and odour and be non-toxic. This imposes other important requirements on a slip agent in addition to its friction-reducing properties.

20 The conventional slip agents of choice in the plastics industry are fatty amides. These additives are widely used in polyolefins such as polyethylene, polypropylene, and related copolymers. Fatty amides employed as slip additives are generally manufactured from fatty acids containing between 16 and 22 carbon atoms and are characterised by a variety of structural forms:

- 25 • Primary amides which can be either monounsaturated (as exemplified by erucamide and oleamide) or saturated (as exemplified by stearamide and behenamide)
- Secondary amides as exemplified by stearyl erucamide and oleyl palmitamide
- Bis amides such as ethylene bis stearamide

30

In view of their widespread usage in polymer systems, it is clearly logical to consider fatty amides as slip agents for polyesters such PET. However we have established that although fatty amides do demonstrate some friction reducing properties in PET, the lowering of the coefficient of friction is much less than in polyolefins. Moreover all amides cause discolouration in injection moulded PET which will severely restrict their utility in this polymer.

35

Conventional slip agent technology cannot therefore be readily applied to in PET. This is particularly the case in bottle (preform) manufacture where in addition to low coefficient of friction, other strict requirements with regard to colour, taste and odour must be met.

5

It is therefore an object of the present invention to provide compositions having improved slip and anti-block characteristics when used in polymers such as PET and wherein other properties of the polymer are not adversely affected.

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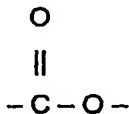
According to a first aspect of the present invention there is provided use of a compound of general formula 1 as a slip agent in a polymer:



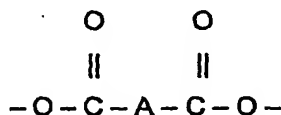
15 wherein: R and R¹ represent hydrocarbon moieties, each hydrocarbon moiety comprising 6 to 24 carbon atoms and wherein R and/or R¹ may be linear, branched chain, saturated or contain one or more double bonds;

X represents one of the moieties:

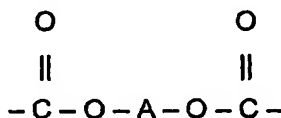
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wherein A represents a hydrocarbon moiety comprising 2 to 36 carbon atoms and may be linear, branched chain, saturated or contain one or more double bonds.

35

25. Preferably the total number of carbon atoms in R, R¹ and X is greater than

5 In a particularly preferred embodiment the total number of carbon atoms in R, R¹ and X is greater than 35.

Preferably X represents the moiety



and the total number of carbon atoms in R, R¹ and X is between 36 and 44.

15 In a particularly preferred embodiment the composition of general Formula 1 is selected from the group comprising stearyl stearate, stearyl behenate, behenyl behenate and ethylene glycol distearate.

Preferably said polymer comprises a polyester.

20 In a particularly preferred embodiment the polymer is selected from the group comprising:-

poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
poly(ethylene isophthalate)
25 poly(ethylene 2,6-naphthalenedicarboxylate)
poly(ethylene phthalate)
poly(ethylene terephthalate).

30 Preferably said composition of general Formula 1 is present in said polymer in an amount of between 0.1% to 1.0% wt/wt.

In a particularly preferred embodiment said composition is present in said polymer in an amount of between 0.2% to 0.75% wt/wt.

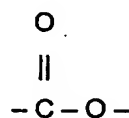
According to a second aspect of the invention there is provided a polymer incorporating one or more slip agents of general Formula 1:



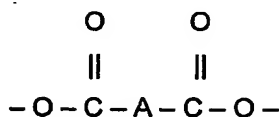
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wherein: R and R¹ represent hydrocarbon moieties, each hydrocarbon moiety comprising 6 to 24 carbon atoms and wherein R and/or R¹ may be linear, branched chain, saturated or contain one or more double bonds;

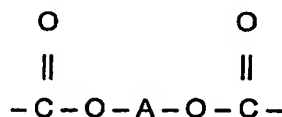
10 X represents one of the moieties:



15



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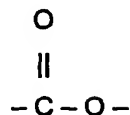


25 wherein A represents a hydrocarbon moiety comprising 2 to 36 carbon atoms and may be linear, branched chain, saturated or contain one or more double bonds.

Preferably the total number of carbon atoms in R, R¹ and X is greater than 25.

30 In a particularly preferred embodiment the total number of carbon atoms in R, R¹ and X is greater than 35.

Preferably X represents the moiety



5

and the total number of carbon atoms in R, R¹ and X is between 36 and 44.

In a particularly preferred embodiment the slip agent of general Formula 1 is selected from the group comprising stearyl stearate, stearyl behenate, behenyl
10 behenate and ethylene glycol distearate.

Preferably said polymer is a polyester.

Preferably said polymer is selected from a group comprising:-

15

poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
poly(ethylene isophthalate)
poly(ethylene 2,6-naphthalenedicarboxylate)
20 poly(ethylene phthalate)
poly(ethylene terephthalate)
and co-polymers thereof.

Preferably said slip agent(s) are present in said polymer in an amount of
25 between 0.1% to 1.0% wt/wt.

In a particularly preferred embodiment said slip agent(s) are present in said polymer in an amount of between 0.2% to 0.75% wt/wt.

30 According to a third aspect of the present invention there is provided a method of treating a polymer to increase the slip of said polymer said method comprising incorporating into said polymer a composition of general Formula 1 as defined above.

35 Preferably said polymer is a polyester.

Preferably said polymer is selected from a group comprising:-

- poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
5 poly(ethylene isophthalate)
poly(ethylene 2,6-naphthalenedicarboxylate)
poly(ethylene phthalate)
poly(ethylene terephthalate)
and co-polymers thereof.

10

Preferably the said composition of general Formula 1 is present in said polymer in an amount of between 0.1% to 1.0% wt/wt.

- 15 In a particularly preferred embodiment said polymer in an amount of between 0.2% to 0.75% wt/wt.

According to a fourth aspect of the present invention there is provided a container made from a polymer as described herein, incorporating a slip agent of general Formula 1.

20

Preferably said container is formed from a polyester.

Preferably said container is formed from a polymer selected from a group comprising:-

25

- poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
poly(ethylene isophthalate)
poly(ethylene 2,6-naphthalenedicarboxylate)
30 poly(ethylene phthalate)
poly(ethylene terephthalate)
and co-polymers thereof.

- 35 According to a fifth aspect of the present invention there is provided a film made from a polymer as described herein incorporating a slip agent of general Formula 1.

Preferably said film is formed from a polyester.

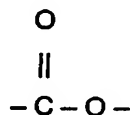
Preferably said film is formed from a polymer selected from a group comprising:-

- 5 poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
poly(ethylene isophthalate)
poly(ethylene 2,6-naphthalenedicarboxylate)
poly(ethylene phthalate)
- 10 poly(ethylene terephthalate)
and co-polymers thereof.

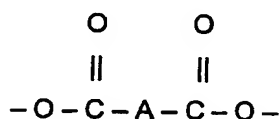
The present invention also extends to include a composition comprising a
copolymer of a polyester and a compound of general Formula 1 wherein: R and R¹
15 represent hydrocarbon moieties, each hydrocarbon moiety comprising 6 to 24
carbon atoms and R and/or R¹ may be linear, branched chain, saturated or contain
one or more double bonds;

X represents one of the moieties:

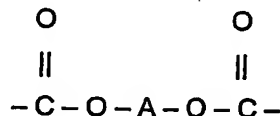
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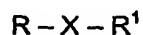
wherein A represents a hydrocarbon moiety comprising 2 to 36 carbon atoms and
may be linear, branched chain, saturated or contain one or more double bonds.

35

The present invention therefore relates to the discovery of a novel slip additive for PET which is highly effective in lowering the coefficient of friction of the fabricated article whilst maintaining low colour and high clarity. More particularly, additives conforming to this invention afford a rapid reduction in the coefficient of friction that is maintained during long-term storage of the moulded part. This is particularly critical in the production of preforms and bottles from PET.

The term PET as used herein in describing this invention includes all polymeric and copolymeric forms of poly (ethyleneterephthalate). The compounds of this invention are also effective slip agents for other polyester polymers and copolymers as exemplified by polybutylene terephthalate and poly (ethylene naphthalate).

The additives of this invention conform to the general structure:



where R and R' are hydrocarbon moieties, each comprising 6 to 24 carbon atoms, and may be linear or branched and be fully saturated or contain one or more double bonds.

X conforms to one of the following structures:



or



or



where A is a hydrocarbon moiety comprising 2 to 36 carbon atoms, and may be linear or branched and be fully saturated or contain one or more double bonds.

In a preferred embodiment of the invention the total number of carbon atoms contained within R, R' and X is greater than 25 and preferably greater than 35.

5 Examples of preferred additives conforming to this invention are stearyl stearate, stearyl behenate, behenyl behenate and ethylene glycol distearate.

To achieve the required level of slip performance in PET, the additives of this invention are incorporated at levels of between 0.1% and 1% and preferably between 0.2% and 0.75% wt/wt.

10

The slip additives of this invention may be incorporated into the polymer by a number of processes well known to those skilled in the art. For example they may be added directly to the resin by melt dosing at the point of extrusion, by conventional masterbatch addition or by incorporation using liquid colour systems.

15

Examples

To demonstrate the effectiveness of the aforementioned additives in reducing the friction of PET surfaces the following procedure was adopted.

20

A PET co-polymer (IV 0.8) suitable for the manufacture of bottles and other food packaging containers by injection moulding, blow moulding or a combination of both was used. The PET was dried for 8 hours at 145°C and the additive coated directly onto the surface of the polymer by tumble mixing whilst the polymer was still

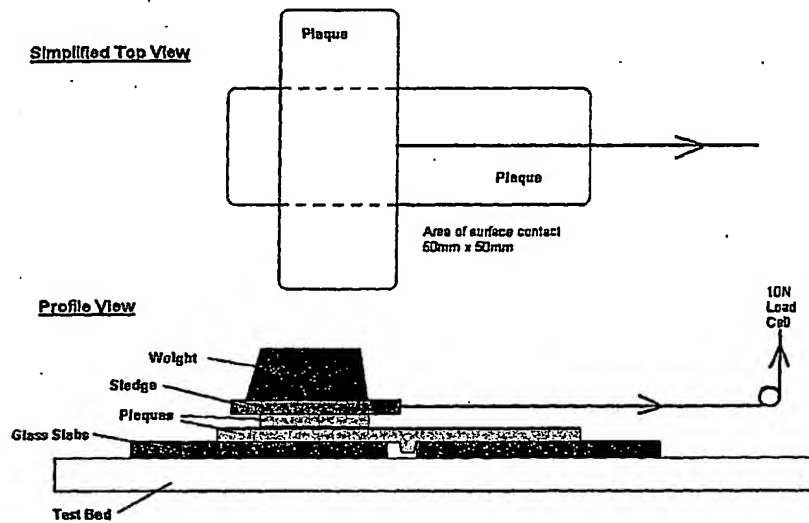
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hot. The PET was moulded into 100 x 50 x 2 mm plaques on a 35 tonne lock injection-moulding machine using the following conditions:

30	Temperature:	All zones at 270°C
	Injection Pressure:	85 Bar
	Shotsize:	29.0mm
	Pack:	20 Bar; 3 secs
	Hold:	75 Bar; 3 secs
35	Cooling:	20 secs
	Tool Temp:	10°C

The Coefficient of Friction (static and kinetic) of the resulting plaques were then measured on a Lloyd LRX tensile tester and a 10N load cell at the following time intervals after moulding – 1 hour, 24 hours, 1 week and 2 weeks. The friction method was adapted from ASTM 1894. The sledge weight including the plaque was 1000g and the area of surface contact between the two plaques was 50mm x 50mm (see diagram). The test was run over a distance of 60mm at 150mm/min. Each test was conducted 5 times for each time interval using new plaques on each run. A diagram of the test apparatus is given below.

10



15

Figure 1

A summary of the slip additives tested is given below:

TABLE 1

	Name	Addition level (%)	Colour CIELab b value	Slip (dynamic CoF)				Appearance (visual inspection)	Comments
				Initial	1 day	1 week	2 weeks		
1	Natural PET	N/A	1.6	0.454	0.503	0.364	0.461	Neutral colour, transparent	Moulded well
2	Stearamide	0.5	3.2	-	0.473	0.397	0.347	Yellow, transparent	Some scratch resistance
3	Stearyl erucamide	0.5	2.7	-	0.383	-	0.327	Yellow, transparent	Some scratch resistance
4	erucamide	0.5	3.5	0.38	0.35	0.32	0.31	Yellow, transparent	Some scratch resistance
5	Behenamide	0.5	3.3	0.341	-	0.408	0.265	Yellow, transparent	Some scratch resistance
6	Behenamide/erucamide	0.5	3.1	0.379	-	0.374	0.329	Yellow, transparent	Some scratch resistance
7	Butyl Stearate	0.5	2	0.335	0.400	0.302	0.316	Neutral colour, transparent	Poor scratch resistance
8	Butyl Behenate	0.5	1.7	0.33	0.34			Neutral colour, transparent	Moulded well little plate out
9	Ethyl hexyl Stearate	0.5	1.9	0.299	0.420	0.266	0.358	Neutral colour, transparent	No moulding issues, reasonable scratch
10	Lauryl Palmitate	0.5	1.7	0.301	0.307	0.259	0.290	Neutral colour, transparent	No moulding issues, poor scratch, greasy to touch
11	Myristyl palmitate	0.5	1.8	0.356	0.288	0.202	0.268	Neutral colour, transparent	Some plateout on tool. Some scratch resistance
12	Stearyl Behenate	0.2	1.4	0.288	0.309	0.245	0.283	Neutral colour, transparent	Small amount of plate out otherwise good.
13	Stearyl Behenate	0.5	-	0.361	0.218	0.200	0.199	Neutral colour, milky white	Moderate plate out, Good scratch resistance
14	Oleyl Behenate	0.5	-	0.38	0.41	0.48		Neutral colour, milky white	Greasy feel

	Name	Addition level (%)	Colour CIELab b value	Slip (dynamic CoF)				Appearance (visual inspection)	Comments
15	Behenyl behenate	0.5	-	0.56	0.37			Neutral colour, milky white	Moulded well, low plate out
16	Calcium Stearate	0.5	3.1	-	0.554	0.451	0.428	Yellow. Transparent	No slip
17	Zinc Stearate	0.5	3.4	-	0.558	0.496	0.461	yellow, transparent	No slip
18	Penta Tetra Behenate	0.5	-	0.516	0.329	0.310	0.450	Milky white	Moderate scratch resistance
19	Pentaerthritol dioleate	0.5	1.7	-	-	-	-	Neutral colour, transparent	Excessive Stick Slip
20	Pentaerthritol tetrastearate	0.5	-	-	0.437	-	0.351	Milky white	
21	Pentaerthritol monooleate	0.5	2	-	-	-	-	Neutral colour transparent	Excessive Stick Slip
22	Glycerol monostearate 40% mono	0.5	1.5	-	0.478	0.450	0.414	Neutral colour, transparent	Little or no slip
23	Glycerol monobehenate	0.5	2.5	-	0.518	0.447	0.449	Slight yellow colour, transparent	Little or no slip
24	Glycerol monostearate 90% mono	0.5	1.8	-	-	-	-	Neutral colour, transparent	Excessive Stick Slip
25	Behenic Acid	0.5	1.7	-	0.448	0.428	0.354	Neutral colour, transparent	May react with polymer
26	PEG 200 dierucate	0.5	1.1	0.347	-	0.508	0.431	Neutral colour, transparent	No slip
27	PEG 400 dierucate	0.5	0.9	0.378	-	0.509	0.464	Neutral colour, transparent	No slip
28	PEG 200 dioleate	0.5	1.4	-	0.574	-	0.484	Neutral colour, transparent	No slip
29	PEG 400 monolaurate	0.5	1.9	-	0.576	-	-	Neutral colour, transparent	Excessive Stick Slip
30	Sorbitan monostearate	0.5	2.8	-	-	-	-	Slight yellow colour	Excessive Stick Slip

	Name	Addition level (%)	Colour CIELab b value	Slip (dynamic CoF)				Appearance (visual inspection)	Comments
31	2 mol ethoxylated stearyl alcohol	0.5	2	-	-	-	-	Neutral colour, transparent	Excessive Stick Slip
32	10 mol ethoxylated stearyl alcohol	0.5	2.1	-	-	-	-	Neutral colour, transparent	Excessive Stick Slip

- Indicates a value was not measurable.

5 The superior performance of the additives of this invention can be readily appreciated by reference to the above results.

Natural PET with no additive (1) gave an average coefficient of friction over the 14-day test period of 0.445 with a recorded maximum of 0.503.

10 Conventional amide slip agents as exemplified by erucamide (4) lowered the coefficient of friction to between 0.38 and 0.31 but resulted in severe yellowing of the polymer.

15 Additives conforming to this invention (7 to 15) afforded an equivalent or greater reduction in the coefficient of friction compared with conventional amide slip agents but the polymer plaques remained clear and transparent. In the case of stearyl behenate (12,13) which represents a preferred embodiment of this invention (in that it contains a total of 40 carbon atoms), a very low coefficient was achieved (average 0.281) at a much reduced addition level.

20

It is of note that some esters of polyethylene glycol (not conforming to this invention) as exemplified by PEG 200 dierucate (26) afforded an initial reduction in the coefficient of friction but this effect diminished over the 14-day test period. This renders compounds of this nature of little value as a long-term slip agents for PET.

25

It is envisaged that mixtures of slip agents of general formula 1 can be used in polymers and co-polymers and that such agents may also be used in combination with known slip agents.

Thus it can be clearly seen that additives conforming to this invention provide the unique combination of a rapid and long-lasting reduction in the coefficient of friction of PET whilst maintaining low colour and high transparency.

5 PREPARATION 1

Materials

85/90% behenic acid, AV=163.7 mg KOH/g, (mwt 342.7 g/mol), 200.0 g (0.584 mole).
 10 n-butanol (butan-1-ol) 99.4+%(Aldrich), (mwt 74.12 g/mol), 400.0 g (5.397 mole).
 sulphuric acid (98% min) catalyst, 4.0 g, or 1% on wt of butanol.

Procedure

15 A flask equipped with a stirrer and vertical water-cooled reflux condenser, was charged with the materials above and heated to and maintained at 110-120°C under air at atmospheric pressure with constant reflux of butanol for approximately 4.5 hours. The resulting mixture was transferred to a separating funnel then 1 L of n-heptane @ 60°C added, followed by 2 L of saturated brine solution. The whole
 20 mixture was shaken and the phases allowed to separate. The aqueous phase was run off, and the heptane phase retained. The heptane phase was then repeatedly washed with ca. 1 L of warm (60°C) distilled water until washings were pH 6. The heptane phase was then dried over anhydrous sodium sulphate and filtered. The
 25 filtrate was evaporated to constant weight on a rotary evaporator @ 70°C under 700 mmHg vacuum. Finally, the headspace of the vessel was blown with nitrogen for ca. 15 minutes to remove traces of butanol smell.

Yield 186g (theoretical maximum yield=232.9 g) 80% yield.

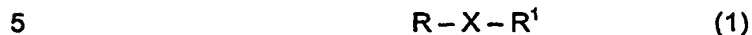
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Analysis of final product:

AV	4.6	mg KOH/g
OHV	10.0	mg KOH/g
Sap value	137.3	mg KOH/g
35 moisture	0.02	% wt
colour	156	Hazen

Claims:

1. Use of a compound of general formula 1 as a slip agent in a polymer:

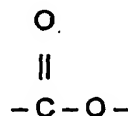


wherein: R and R¹ represent hydrocarbon moieties, each hydrocarbon moiety comprising 6 to 24 carbon atoms and wherein R and/or R¹ may be linear, branched chain, saturated or contain one or more double bonds;

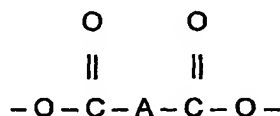
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X represents one of the moieties:

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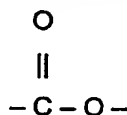
- 25 wherein A represents a hydrocarbon moiety comprising 2 to 36 carbon atoms and may be linear, branched chain, saturated or contain one or more double bonds.

2. Use of a compound of general Formula 1 as a slip agent in a polymer as claimed in Claim 1 wherein the total number of carbon atoms in R, R¹ and X is greater than 25.

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3. Use of a composition of general Formula 1 as a slip agent as claimed in Claim 1 or Claim 2 wherein the total number of carbon atoms in R, R¹ and X is greater than 35.

4. Use of a composition of general Formula 1 as a slip agent in a polymer as claimed in any preceding claim wherein X represents the moiety



and the total number of carbon atoms in R, R¹ and X is between 36 and 44.

5. Use of a composition of general Formula 1 as a slip agent in a polymer as claimed in any preceding claim wherein the composition of general Formula 1 is selected from the group comprising stearyl stearate, stearyl behenate, behenyl behenate and ethylene glycol distearate.

6. Use of a composition of general Formula 1 as a slip agent in a polymer as claimed in any preceding claim wherein said polymer comprises a polyester.

7. Use of a composition of general Formula 1 as a slip agent in a polymer as claimed in Claim 6 wherein the polymer is selected from the group comprising:-

- poly(butylenes terephthalate)
 poly(cyclohexanedimethylene terephthalate)
 poly(ethylene isophthalate)
 poly(ethylene 2,6-naphthalenedicarboxylate)
 poly(ethylene phthalate)
 poly(ethylene terephthalate)
 and co-polymers thereof.

8. Use of a composition of general Formula 1 as a slip agent in a polymer according to any preceding claim wherein said composition of general Formula 1 is present in said polymer in an amount of between 0.1% to 1.0% wt/wt.

9. Use of a composition of general Formula 1 as a slip agent in a polymer according to Claim 8 wherein said composition is present in said polymer in an amount of between 0.2% to 0.75% wt/wt.

10. Use of a composition of general Formula 1 as a slip agent in a polymer substantially as herein described.

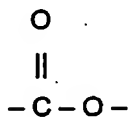
11. A polymer incorporating one or more slip agents of general Formula 1:



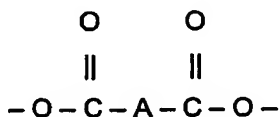
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wherein: R and R¹ represent hydrocarbon moieties, each hydrocarbon moiety comprising 6 to 24 carbon atoms and wherein R and/or R¹ may be linear, branched chain, saturated or contain one or more double bonds;

- 10 X represents one of the moieties:



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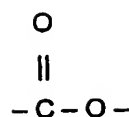
- 25 wherein A represents a hydrocarbon moiety comprising 2 to 36 carbon atoms and may be linear, branched chain, saturated or contain one or more double bonds.

12. A polymer as claimed in Claim 11 wherein incorporating one or more slip agents of general Formula 1 wherein the total number of carbon atoms in R, R¹ and X is greater than 25.

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13. A polymer as claimed in Claim 11 or Claim 12 incorporating one or more slip agents of general Formula 1 wherein the total number of carbon atoms in R, R¹ and X is greater than 35.

- 35 14. A polymer as claimed in any of Claims 11, 12 or 13 incorporating one or more slip agents of general Formula 1 wherein X represents the moiety



5 and the total number of carbon atoms in R, R¹ and X is between 36 and 44.

15. A polymer as claimed in any of claims 11, 12, 13 or 14 incorporating one or more slip agents of general Formula 1 wherein the composition is selected from the group comprising stearyl stearate, stearyl behenate, behenyl behenate and ethylene glycol distearate.

16. A polymer as claimed in any of Claims 11 to 15 inclusive incorporating one or more slip agents of general Formula 1 wherein said polymer is selected from a group comprising:-

15 poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
poly(ethylene isophthalate)
poly(ethylene 2,6-naphthalenedicarboxylate)
20 poly(ethylene phthalate)
poly(ethylene terephthalate)
or co-polymer thereof.

17. A polymer as claimed in any of Claims 11 to 16 inclusive incorporating one or more slip agents of general Formula 1 wherein said slip agent(s) are present in said polymer in an amount of between 0.1% to 1.0% wt/wt.

18. A polymer as claimed in Claim 17 wherein said slip agent(s) are present in said polymer in an amount of between 0.2% to 0.75% wt/wt.

30 19. A polymer incorporating one or more slip agents of general Formula 1 substantially as herein described.

20. A method of treating a polymer to increase the slip of said polymer said method comprising incorporating into said polymer a composition of general Formula 1.

21. A method of treating a polymer as claimed in Claim 20 wherein said polymer is selected from a group comprising:-

- 5 poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
poly(ethylene isophthalate)
poly(ethylene 2,6-naphthalenedicarboxylate)
poly(ethylene phthalate)
10 poly(ethylene terephthalate)
or co-polymer thereof.

22. A method according to Claim 21 wherein said composition of general Formula 1 is present in said polymer in an amount of between 0.1% to 1.0% wt/wt.

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23. A method according to Claim 22 wherein said composition of general Formula 1 is present in said polymer in an amount of between 0.2% to 0.75% wt/wt.

24. A container made from a polymer as claimed in any of Claims 11 to 19 inclusive.

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25. A container as claimed in Claim 24 wherein said container is formed from a polymer selected from a group comprising:-

- 25 poly(butylenes terephthalate)
poly(cyclohexanedimethylene terephthalate)
poly(ethylene isophthalate)
poly(ethylene 2,6-naphthalenedicarboxylate)
poly(ethylene phthalate)
30 poly(ethylene terephthalate)
or co-polymer thereof.

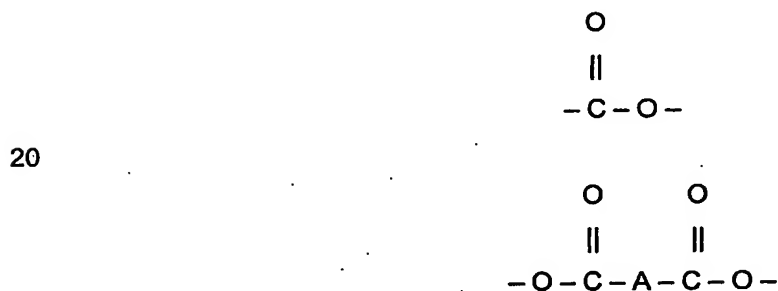
26. A film made from a polymer as claimed in any of Claims 11 to 19 inclusive.

35 27. A film as claimed in Claim 26 wherein said film is formed from a polymer selected from a group comprising:-

poly(butylenes terephthalate)
 poly(cyclohexanedimethylene terephthalate)
 poly(ethylene isophthalate)
 5 poly(ethylene 2,6-naphthalenedicarboxylate)
 poly(ethylene phthalate)
 poly(ethylene terephthalate)
 or co-polymer thereof.

- 10 28. A composition comprising a copolymer of a polyester and a compound of general Formula 1 wherein: R and R¹ represent hydrocarbon moieties, each hydrocarbon moiety comprising 6 to 24 carbon atoms and R and/or R¹ may be linear, branched chain, saturated or contain one or more double bonds;

- 15 X represents one of the moieties:



- 30 wherein A represents a hydrocarbon moiety comprising 2 to 36 carbon atoms and may be linear, branched chain, saturated or contain one or more double bonds.

ABSTRACTCOMPOUNDS

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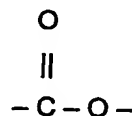
Use of a compound of general formula 1 as a slip agent in a polymer:



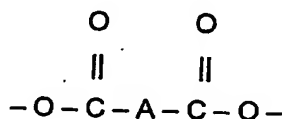
- 10 wherein: R and R¹ represent hydrocarbon moieties, each hydrocarbon moiety comprising 6 to 24 carbon atoms and wherein R and/or R¹ may be linear, branched chain, saturated or contain one or more double bonds;

X represents one of the moieties:

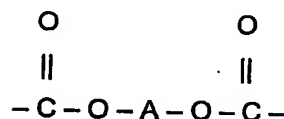
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wherein A represents a hydrocarbon moiety comprising 2 to 36 carbon atoms and may be linear, branched chain, saturated or contain one or more double bonds.

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